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Flexural strength of heat cure acrylic denture base resin by denture cleansing and plant extract immersion: An *in-vitro* study

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Abstract

Background: Adequate mechanical properties, sufficient esthetics, hygiene, and easy handling are basic requirements for denture base polymers. The present *in vitro* study evaluated the flexural strength of heat-cure acrylic denture base resin by denture cleansing and plant extract immersion.

Materials and Methods: The present *in vitro* study was conducted on 60 heat-cure acrylic denture base resin material specimens. The specimens were divided into three groups. Group I specimens were immersed in distilled water, group II in denture cleanser and group III in thyme essential oil. The flexural strength was measured.

Results: The mean flexural strength in group I was 83.2 MPa, in group II was 89.5 MPa and in group III was 91.5 MPa. The difference was significant ($P < 0.05$).

Conclusion: Authors found that thyme essential oil showed better flexural strength than combination method and can be effectively used as denture cleanser.

Keywords: Thyme essential oil, Distilled water, Denture cleaner

Introduction

Adequate mechanical properties, sufficient esthetics, hygiene, and easy handling are basic requirements for denture base polymers. In long-term use, denture base material can get colonized and infected by microorganisms [1]. Efficient and regular hygiene is important for long-term upkeep of complete denture and is indispensable for the general health of edentulous people. Denture can be cleaned mechanically, chemically, or by combination of these methods. Different types of chemical solutions have been recommended for denture disinfection. An ideal denture cleanser should be biocompatible, bactericidal, fungicidal, harmless, and nontoxic to the structure of denture; should be effectively remove deposits; and should be easy to use [2].

Most of the partial denture or complete denture patients leave the dental clinic with little or no knowledge of maintenance of their dentures. This could be attributed to dental practitioners' failure to adequately educate the patient regarding the availability of different methods of cleansing /disinfecting dentures, the post insertion complications and systemic implications of a poorly maintained dentures. This scenario is widely prevalent due to dentist unawareness of the different disinfecting techniques, lack of quality time for individual patient care, patient's inability to implement the disinfection and patient's negligence of maintaining denture hygiene [3]. Natural products and essential oils are promising therapeutic tools for oral infection. These oils are complex mixtures of volatile compounds obtained from plant with antioxidant and antimicrobial properties against wide range of pathogens, including *Candida albicans* and dermatophytes [4]. The present *in vitro* study evaluated the flexural strength of heat-cure acrylic denture base resin by denture cleansing and plant extract immersion.

Materials and Methods

The present *in vitro* study was conducted in the department of conservative dentistry. It comprised of 60 heat-cure acrylic denture base resin material specimens. The study was approved from institutional ethical committee. All specimens of heat-cure acrylic denture base resin material were fabricated with dimensions of 60 mm × 20 mm × 3.5 mm.

The specimens were divided into three groups. Group I specimens were immersed in distilled water, group II in denture cleanser and group III in thyme essential oil. The flexural strength was measured using a three-point bending test in Instron 3369 universal testing machine. The specimens were subjected to flexion until fracture. Results were tabulated and subjected to statistical analysis. P value less than 0.05 was considered significant.

Results

Table I: Distribution of patients

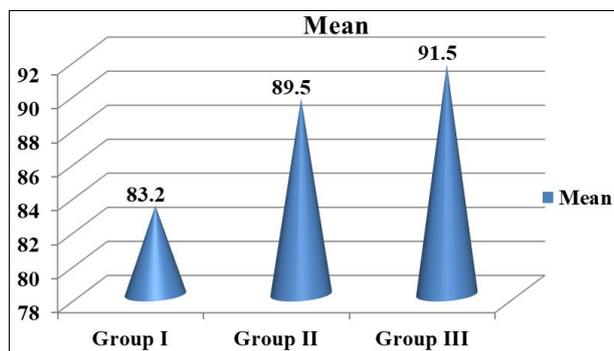
| Groups | Group I | Group II | Group III |
|--------|---------------------------|------------------|---------------------|
| Method | Distilled water (Control) | Denture cleanser | Thyme essential oil |
| Number | 20 | 20 | 20 |

Table I shows that group I specimens were immersed in distilled water, group II in denture cleanser and group III in thyme essential oil. Each group had 20 specimens.

Table II: Assessment of flexural strength

| Groups | Mean | P value |
|-----------|------|---------|
| Group I | 83.2 | 0.02 |
| Group II | 89.5 | |
| Group III | 91.5 | |

Table II, graph I shows that mean flexural strength in group I was 83.2 MPa, in group II was 89.5 MPa and in group III was 91.5 MPa. The difference was significant ($P < 0.05$).



Graph I: Assessment of flexural strength

Discussion

An ideal denture cleanser should be simple to use, effectively remove organic and inorganic matter from denture surface, have bactericidal and fungicidal properties and should cause least amount of damage to the denture base. Chemical agents for denture cleansing have the advantage of being simple to use and several studies have shown their efficacy in reducing biofilm formation *in vitro* and *in vivo*. Many patients in long-term care hospitals cannot adequately brush their dentures because of disease, dementia and poor manual dexterity. Such inadequate cleaning may allow for the growth of Candidal and bacterial spp., which could serve as reservoirs for disseminating infections. According to several studies, the use of denture cleansers significantly reduced the number of microorganisms on dentures in patients, especially in a hospitalized geriatric population [5].

Various studies, show positives and possible negatives with the use of denture cleansers. Investigations and studies have pointed out that, the correct use of chemical cleansers is not associated to alterations in mechanical properties of denture

base materials. Allergy or harmful effects by the proper use of cleansers following manufacturer's direction have also not been reported [6].

Gutiérrez *et al.* [7] had proved that thymol showed complete inhibition of microorganisms such as *C. albicans*, *Aspergillus flavus*, and Goncalve [8] had concluded that thyme oil was efficient against *Streptococcus mutans*. Studies have been done on the thyme essential oil and its properties, but few studies have been done on the effect of thyme essential oil on denture base resin. The present *in vitro* study evaluated the flexural strength of heat-cure acrylic denture base resin by combination method of denture cleansing and plant extract immersion.

In present study, group I specimens were immersed in distilled water, group II in denture cleanser and group III in thyme essential oil. Each group had 20 specimens. Anjum *et al.* [9] in their study, ninety specimens of heat-cure acrylic denture base resin material were fabricated with dimensions of 65 mm × 10 mm × 3.3 mm. The specimens were divided into three groups, namely, Group I–III of thirty specimens each and were immersed in distilled water, denture cleanser, and thyme essential oil, respectively. The flexural strength of specimen was evaluated. Natural plant extract showed better flexural strength than immersed in denture cleanser and control group but statistically was not significant.

We found that mean flexural strength in group I was 83.2 MPa, in group II was 89.5 MPa and in group III was 91.5 MPa. Paranhos Hde *et al.* [10] concluded that overnight immersion in a denture cleansing solution simulating a year half of use did not alter the flexural strength which was 97.61 ± 11.09 MPa, since flexural strength depends on bulk of material, and insignificant change in flexural strength indicates that the bulk of the material remained intact from the influence of cleansers.

Conclusion

Authors found that thyme essential oil showed better flexural strength than combination method and can be effectively used as denture cleanser.

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